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Sanitation
a choice of technologies

Rowan Shirkie

The flush toilet, and the waterborne sewage system that developed along with it, are probably two of the worst detours on which technology has ever taken human progress.

Consider the absurdity of a system where wastes are dumped into water supplies that then require staggering investments of time and money to purify again in order to use for drinking, cooking, and washing.

Consider also that some 1300 million people (about 67 percent of the population of developing countries) lack adequate facilities for the disposal of human wastes, and that the consequent unsanitary conditions produce high disease rates and an estimated 25,000 deaths *per day*.

And consider too, that even if communities in developing countries had the water resources to support the extravagantly inefficient conventional sewerage systems now available, the cost would be about $200 billion in construction costs alone.

A technology, or technologies, that could provide basic sanitation services at a reduced cost — in terms of expending economic, physical, and social resources — would have a profound positive effect on the health of people and their environment.

IDRC and the World Bank recently collaborated in preparing a bibliography and state-of-the-art review of alternative sanitation technologies that could be used in an effort to correct present deficiencies, and avoid the sort of inappropriate solutions that might overextend community resources. The search focussed on innovative approaches to collection, treatment, reuse, and disposal of human wastes in urban (and rural) environments in developing countries.*

Permanent or periodic shortages of water in many developing countries pose severe restrictions on the adoption of any waterborne system. Hot and humid climates also create ideal conditions for the survival of disease causing organisms in human wastes. Poor sanitation in this environment, coupled with endemic malnutrition, is probably the chief cause of the spread of hookworm, diarrhea, enteritis, cholera, and typhoid. The destruction of pathogens in wastes is therefore the first priority of any disposal system in the tropics. As technologies now exist to convert waste material into valuable fertilizer and energy products, and given the importance of both agricultural and energy needs in developing countries, reuse considerations must also become a priority in disposal systems.

Photo: Neill McKee

A pit privy being built in Tanzania. This is probably the most widely-used method of human waste disposal.

The options for low cost sanitation in developing countries seemed to the investigators to fall into three main categories: waterborne options, cartage options, and on-site options.

Waterborne options, that is sewerage systems, are as yet the only solution identified for high-density highrise housing and commercial areas. The concentration of population in these areas tends to minimize the drawbacks associated with sewerage; provision of piped water (usually available in such environments), and cost (the unit cost is reduced in serving a concentrated population). Tied to intelligent water-saving and reuse practices, well managed sewerage systems can be viable options.

Cartage options operate on the same principle as sewerage — removing wastes to locations outside of inhabited areas for disposal or treatment — but without the use of pipes. Such systems consist of a household sewage vault that is emptied periodically by vacuum trucks or smaller pumping carts. Such collection systems are more suited for certain urban sanitation needs than sewerage: capital outlay is low, about a third that of sewers; the system always operates at or near capacity; is labour-intensive; and provides a high level of service when properly operated. Such systems are widely used in Japan and Taiwan, and in cities such as Sydney, Australia, and Oslo, Norway.

On-site options, generally suitable for urban and rural application, can be implemented and operated by individuals. These are basically variations of the pit privy — probably the most widely used technology for excreta disposal — with improvements to environmental and hygienic conditions. Composting toilets, wherein solid organic wastes are biologically converted into a stable, humus-like product, are a promising alternative.

Composting on a larger scale, together with waste stabilization ponds, are two treatment possibilities that offer flexibility and low cost. Waste stabilization ponds are shallow rectangular lakes in which wastes are treated by natural processes based on the activities of bacteria and algae. Both methods are effective in destroying pathogens, and offer reuse possibilities.

Reuse, or recycling of resources such as wastes is already widely practiced in developing countries, not so much for reasons of environmental conservation, as in response to the pressure to exploit every resource potential to its fullest to meet needs. Reuse of human waste may be undertaken through fertilization of crops with treated and untreated nightsoil, irrigation with sewage and stabilization pond effluents, fish and algae production based on wastes, and the generation of biogas.

Sewerage has long been regarded as a universal solution to waste disposal. It is assumed that the technology need simply be introduced to produce a predetermined, predictable result. But sanitation engineers and managers (along with others in different fields) are discovering that their accepted universals break down in developing country contexts. The best, and often the only, solutions arise from an understanding of the unique characteristics of the problems encountered, and take into account the local human and material resources available to solve them. The investigators believe that a step-by-step upgrading compatible with existing sanitation conditions will prove the best approach. Their approach — adaptation, rather than just adoption — implies a dynamic process of problem solving that can produce benefits wherever science and technology are brought to bear on development.

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**IDRC has recently published* Low-cost technology options for sanitation: a state-of-the-art review and annotated bibliography *by Witold Rybczynski, Chongrak Polprasert, and Michael McGarry. A companion volume,* Health aspects of excreta and sullage management *by R. G. Feachem, D.J. Bradley, H. Garelick, and D.D. Mara has been published by the World Bank (Energy, Water and Telecommunications Department, 1818 'H' Street NW, Washington, D.C. 20433, USA).*